

Abstract of the Disclosure

An underground drilling method and apparatus generates intense pressure pulses at a location at
5 the surface. The pressure pulses propagate down through a drill string to a drill bit. The pulses may be generated by creating water hammer in flowing drilling mud. Intensity of the acoustic pulses is increased in the bit nozzles. Vigorous
10 pulsing of the fluid exiting the bit nozzles results in better cleaning of the hole bottom and faster drilling. The pulses may be used to drive the operation of various down hole tools. One type of tool has multiple pistons arranged in series.
15 High pressure pulses move the pistons to generate strong mechanical vibration in the drill string. Vibration of the drill string may also reduce the friction between the drill string and the hole, resulting in lower torque requirements.